

CLAIMS:

1. Apparatus for controlling a plurality of detonators comprising:
a central command station adapted to transmit one or more command signals;
5 one or more blasting machines in signal communication with both the central command station and a group of detonators, each blasting machine including means for generation of a data package comprising a randomly generated access code, means for receiving one or more command signals and one or more data packages transmitted by the central command station, and means for comparing generated and received data
10 packages;
one or more authorization keys adapted for: (a) physical association with one or more blasting machine, (b) direct transfer to and storage of each data package, and (c) physical transfer from the one or more blasting machines to the central command station for delivery of the stored data package(s) to the central command station;
15 whereby the central command station, after receiving the data package(s) from the authorization key(s) transmits one or more command signals and the data package(s) to the blasting machine(s), whereupon any one blasting machine responds to said one or more command signals only if one of the data packages received from the central command station is the same as the data package originally generated by
20 said any one blasting machine.
2. The apparatus according to claim 1, wherein any one data package further comprises a unique identification code corresponding to the blasting machine that generated said any one data package.
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3. The apparatus according to claim 1, wherein the central command station transmits the data package(s) and the command signal(s) to the blasting machine(s) simultaneously.

4. The apparatus according to claim 1, wherein the central command station transmits the data package(s) and the command signal(s) to the blasting machine(s) sequentially.
- 5 5. The apparatus according to claim 1, wherein the central command station further includes encryption means, and each blasting machine further includes descrambling means, so that the one or more command signals and / or the one or more transmitted data packages are encrypted by the encryption means upon transmission from the central command station, and descrambled by the descrambling
10 means upon receipt by each blasting machine.
6. The apparatus according to claim 5, wherein the one or more command signals and / or the one or more data packages are encrypted by 32 bit encryption.
- 15 7. The apparatus according to claim 1, wherein the randomly generated access codes are active for a single blasting event.
8. The apparatus according to claim 1, wherein the randomly generated access codes are active within a predetermined time window, outside of which the one or
20 more blasting machines will not respond to the one or more command signals and the one or more data packages transmitted by said central command station.
9. The apparatus according to claim 1, wherein the central command station is located remote from the one or more blasting machines and said detonators.
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10. The apparatus according to claim 9, wherein the one or more blasting machines and the central command station are in radio-signal communication.

11. The apparatus according to claim 1, wherein the one or more detonators are in signal communication with the one or more blasting machines via low energy detonation cord, shock tube, or electrical connection.
- 5 12. The apparatus according to claim 1, wherein the one or more authorization keys comprises a single authorization key transferable between the one or more blasting machines for storing each of the one or more data packages.
13. The apparatus according to claim 1, wherein the command signals include
10 ARM, FIRE, or DISARM signals.
14. The apparatus according to claim 13, wherein the FIRE signals are specific for each detonator or each group of detonators, each FIRE signal including a delay component to specify a firing delay for each detonator or each group of detonators
15 thereby determining a firing sequence for the detonators.
15. The apparatus according to claim 1, further comprising:
a master key including a memory for storing detonator firing codes;
- 20 wherein each of said detonators includes a built-in firing code, and association of said master key with said central command station permits transfer of stored detonator firing codes to said central command station for transmission to said one or more blasting machines, said one or more blasting machines each including means for relaying said detonator firing codes to said detonators, any one blasting machine
25 relaying said detonator codes and command signals only if one of the data packages received from the central command station is the same as the data package originally generated by said any one blasting machine, each detonator firing only if one of said relayed detonator firing codes relayed from an associated blasting machine is the same as said built-in firing code for said any one detonator.

16. A method of controlling a plurality of detonators, the method comprising the steps of:

- (a) providing a central command station adapted to transmit command signals;
- 5 (b) providing one or more blasting machines each in signal communication with a group of detonators and the central command station;
- (c) generating a data package in each blasting machine, each data package comprising a randomly generated access code;
- (d) providing one or more authorization keys, each authorization key adapted
- 10 for: (a) physical association with one or more blasting machine, (b) direct transfer to and storage of each data package, and (c) physical transfer from the one or more blasting machines to the central command station for delivery of the stored data package(s) to the central command station;
- (e) transferring each authorization key from said one or more blasting
- 15 machines to said central command station;
- (f) inputting each data package from said one or more authorization key to said central command station;
- (g) transmitting one or more command signals together with said one or more data packages from said central command station to said one or more blasting
- 20 machines, any one blasting machine responding to said one or more command signals only if one of the data packages received from the central command station is the same as the data package originally generated by said any one blasting machine.

17. The method according to claim 16, wherein any one data package further

25 comprises a unique identification code corresponding to the blasting machine that generated said any one data package.

18. The method according to claim 16, wherein in step (g) the central command station transmits the data package(s) and the command signal(s) to the blasting machine(s) simultaneously.
- 5 19. The method according to claim 16, wherein in step (g) the central command station transmits the data package(s) and the command signal(s) to the blasting machine(s) sequentially.
- 10 20. The method according to claim 16, wherein in step (g) the one or more command signals and / or the one or more transmitted data packages are encrypted upon transmission by the central command station, and descrambled upon receipt by each blasting machine.
- 15 21. The method according to claim 20, wherein in step (g) the one or more command signals and / or the one or more data packages are encrypted by 32 bit encryption.
22. The method according to claim 16, wherein the randomly generated access
20 codes are active for a single blasting event.
23. The method according to claim 16, wherein the randomly generated access codes are active within a predetermined time window, outside of which the blasting machine will not respond to said one or more command signals and said one or more
25 data packages transmitted by said central command station.
24. The method according to claim 16, wherein the central command station is located remote from said one or more blasting machines and said one or more detonators.

25. The method according to claim 24, wherein the one or more blasting machines and the central command station are in radio-signal communication.
- 5 26. The method according to claim 16, wherein each group of detonators is in signal communication with each blasting machine via low energy detonation cord, shock tube, or electrical connection.
27. The method according to claim 16, wherein the one or more authorization keys
10 comprises a single authorization key transferable between the one or more blasting machines and the central command station for storing each of the one or more data packages.
28. The method according to claim 16, wherein in step (g) the one or more
15 command signals include ARM, FIRE, or DISARM signals.
29. The method according to claim 28, wherein in step (g) the FIRE signals are specific for each detonator or group of detonators, each FIRE signal including a delay component to specify a firing delay for each detonator or group of detonators thereby
20 determining a firing sequence for the detonators.
30. A method of controlling initiation of a plurality of detonators each having a unique built-in firing code, the method comprising the steps of:
- (a) providing a central command station;
- 25 (b) providing one or more blasting machines each in signal communication both with a group of detonators and the central command station;
- (c) generating a data package in each blasting machine, each data package comprising a randomly generated access code;

- (d) providing one or more authorization keys, each authorization key adapted for: (a) physical association with one or more blasting machine, (b) direct transfer to and storage of each data package, and (c) physical transfer from the one or more blasting machines to the central command station for delivery of the stored data package(s) to the central command station;
- (e) transferring each authorization key from said one or more blasting machines to said central command station;
- (f) inputting each data package from said one or more authorization keys to said central command station;
- (g) providing a master key including a memory for storing detonator firing codes;
- (h) transferring the detonator firing codes from the master key to the central command station;
- (i) transmitting one or more command signals, the detonator firing codes, and said one or more data packages from said central command station to said one or more blasting machines, any one blasting machine relaying said detonator codes and command signals to the associated detonators only if one of the data packages received from the central command station is the same as the data package originally generated by said any one blasting machine, each detonator firing only if one of said relayed detonator firing codes relayed from an associated blasting machine is the same as said built-in firing code for said any one detonator.

31. The method according to claim 30, wherein any one data package further comprises a unique identification code corresponding to the blasting machine that generated said any one data package.

32. The method according to claim 30, wherein in step (i) the central command station transmits the detonator codes, the data package(s) and the command signal(s) to the blasting machine(s) simultaneously.

33. The method according to claim 30, wherein in step (i) the central command station transmits the detonator codes, the data package(s) and the command signal(s) to the blasting machine(s) sequentially.

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34. The method according to claim 30, wherein the master key further stores user identification information for recognition by said central command station.

35. The method according to claim 30, wherein the detonator firing codes
10 comprise detonator identification codes and / or detonator delay times.